



Kuster Company
2900 E. 29th Street
Long Beach, CA USA 90806
Telephone 562-595-0661 Fax 562-426-7897 E-Mail kuster@kusterco.com

KUSTER ELECTRONIC GAUGES

K8 EMR 25, K8 EMR 39, K4 EMR 3/4", K4 EMR 3/4" QUARTZ

SERVICE MANUAL

ATTENTION: K8 EMR 25, K8 39 EMR QUARTZ, K4 EMR 3/4", K4 EMR 3/4" QUARTZ GAUGES: DURING ASSEMBLE/ DISASSEMBLE WRENCHES ARE TO BE PLACED ON THE CLOSEST FLATS. NO PIPE WRENCHES ARE TO BE USED ON KUSTER MEMORY GAUGES.

K8 EMR 25, K8 EMR 39 QUARTZ, K4 EMR 3/4" QUARTZ GAUGES: IN ORDER TO AVOID TOOL MALFUNCTIONING, O'RINGS UNDER THE ELECTRONICS HOUSING SHOULD BE REPLACED STRICTLY ACCORDING THE PROCEDURE, DESCRIBED AT THE END OF THIS MANUAL.

WARNING: ALL ELECTRONIC GAUGES: UNDER NO CIRCUMSTANCES IS THE TEMPERATURE RATING OF THE BATTERIES TO BE EXCEEDED.

WORK PREPARATION:

1. Make sure that the tool is able to meet the anticipated requirements of the well to be surveyed, i.e. pressure and temperature limitations.
2. Make sure that the battery meets the requirements of the well to be surveyed
3. Check the battery voltage using the supplied battery tester.
With the load adapter attached to the DMM, the selector switch to Vdc, and the battery connected to the load adapter. Turn on DMM and read voltage. The battery should be disconnected from the load adapter before 1 minute has elapsed. The load adapter has a 100Ω resistor internally, which simulates the load of the instrument and also serves to 'wake up' the battery under certain conditions. The checking of a battery without the load adapter does not accurately reflect the condition of the battery.
The voltage of the battery should in ranges specified in Battery Voltage and Usage Section of this manual.
4. Verify the instrument has a current DWT verification on file. Ideally, the instrument should have been calibrated within the previous year, with a two or four point dead weight check following the last survey.
5. Connect gauge through interface to the computer
6. Program the gauge with desired rate. (See software operational manual for a more detailed explanation of programming options)
7. Apply a bead of Kuster hi-temp thread lube to all threads and across o'ring glands
8. Disconnect the buffer tube assembly from transducer sub
9. Drop some oil into the transducer sub until it's full. Never insert syringe or any other device into the transducer port more than 1/8" as damage to transducer may occur.
10. Using oil pump fill buffer tube assembly with a light mineral oil. Don't try too hard pushing the pump lever. Slow, but steady force until oil flows from the end of the tube, that's all you need.
11. Install buffer tube assembly on the gauge

12. Fill up the tandem sub with the mineral oil.
13. Install tandem sub on the gauge
14. Wipe the oil residues from the gauge and put a piece of scotch tape on the tandem sub hole. Don't forget to take it off before running the tool into the well.
15. Install bull nose

Now tool is ready and could be delivered to the well site.

AFTER ARRIVAL:

1. Connect the battery and note date and time of connection
2. Verify proper operation of the instrument by viewing 4 flashes on the battery's LED.
3. Install battery housing hand tight and finishing tightening with wrenches. Do not over torque.
4. Connect wireline socket.
5. Remove the tape from the tandem sub put gauge into the well.
6. With the lubricator pressured up, allow the gauge at least 15 minutes within the lubricator to stabilize before running in the hole.
7. If a static gradient is being run, allow at least ten minutes per stop to allow the gauge to stabilize and to provide for a sufficient number of samples to be recorded.

Note: the tool should not be pulled in or out in the hole faster than 50 m/min.

AFTER THE SURVEY:

1. Pull gauge out of the well.
2. Wash down exterior of tool and wipe dry.
3. Remove battery housing and disconnect the battery (note the time and date).
4. Disconnect tandem sub from the gauge.
5. Disconnect buffer tube assembly
6. Wash down nose of tool, tandem sub and buffer tube assembly with solvent.
7. Flush transducer port with solvent using syringe and allow to drain
8. Flush and fill buffer tube assembly with clean silicone oil and set aside
9. Connect gauge through comm. box to the computer, wait for four LED flashes on comm. box and download data to the hard drive (See software operational manual)
10. Remove old o'rings from I/O connector side of the gauge

11. Wipe clean the threads and O'ring surfaces and inspect visually all threads for signs of damage, galling and etc.
12. Install two new O'rings under the battery housings
13. Lube threads with Kuster high temp lube
14. Program tool for 2 point DWT
15. Install battery and battery housing
16. Run 2 point DWT
17. Download the data from the gauge.
18. Review, record & file 2 point DWT
19. Fill transducer port with fresh oil and install buffer tube assembly onto it.
20. Install tandem sub and bull nose

BATTERY VOLTAGE AND USAGE

Given the variety of tests and surveys that exist in the downhole environment a definitive guideline for battery usage is impossible. The technician needs to use a certain amount of judgment on when to use or not to use a particular battery pack. The decision should be based on three things.

1. The length of the test (survey) to be run.
2. The amount of time a battery has been used.
3. The voltage the battery shows on the digital multimeter with the load (battery tester) applied.

The circuit board electronics of both the strain and quartz gauges require approximately 3 volts minimum to operate correctly. And the quartz transducer requires 6.5 volts minimum to operate correctly. Since lithium batteries maintain the maximum stated voltage for the useable life of the battery; once the voltage starts to drop their useable life is short indeed.

For example: Our AA batteries are rated at 1.5Ah. But this number is taken after 80% of the life has been used. The remaining voltage is approximately 2.5volts. Not enough to operate the gauge properly. 1Ah leaves approximately 3-3.2volts left. Realistically the battery should not be used past 1Ah. Of course this is where the judgment of the operator comes into play. Also don't forget that lithium batteries passivate (go to sleep) and need to be awakened. This can cause the voltage to be much lower than it really is. Wake them up by warming them or using the battery load tester.

Recommendation:

AA lithium- no load voltage- 3.2volts.... Do not use.

CC lithium- no load voltage- of 6.9 volts...do not use.

Recommendation:

AA lithium- with load adapter- 2.9 volts.... Do not use.

CC lithium- with load adapter- 6.5 volts...do not use.

LITHIUM OXYHALIDE PRIMARY CELLS

Basic Handling Note:

With the exception of QTC and PC cells, every Electrochem lithium battery is equipped with an internal safety fuse. These very fast acting fuse elements can be opened with even the slightest short circuit. Therefore, use care in handling these products to prevent any potential short circuit condition. If a cell fuse should open, do not attempt to repair it yourself. Contact Electrochem distributor for assistance.

Safety

Although every Electrochem lithium battery is designed and manufactured for safe operation, it is important to observe several key points:

- Never store or operate a battery above its designated maximum temperature.
- Never store cells of different chemistry, size, age, or discharge depth.
- Under no circumstances should the terminal cap of a cell be removed.
- Do not crush, puncture, or attempt to disassemble a cell or battery pack.
- Never use excessive force, or hammering to free batteries lodged inside any type of housing.
- Standard industrial safety practices, such as the wearing of eye protection, should always be employed when handling batteries or other high power energy devices.

Shipping

Electrochem lithium batteries are shipped in full compliance with all rules and regulations governing proper packaging as set forth by the United Nations and enforced by various international agencies. Whenever re-shipping lithium batteries, the customer must ensure that all methods used are in compliance with the latest regulations.

Disposal

The regulations concerning the disposal of lithium batteries vary widely. Local disposal regulations differ and subject to change. Contact the proper Environmental Agency in your area for questions regarding the disposal of lithium batteries.

Specifications 3B1065 Series PMX150 (AA cells)

Open circuit voltage at room temperature.....	3.9V
Rated discharge current.....	20mA
Rated capacity.....	1.6 Ah
Maximum continuous discharge current.....	150 mA
Operating temperature range.....	-40C to +150C -40F to +302F
Weight.....	15 g
Safety fuse.....	4 A link
Lithium weight.....	0.5 g

This product is not restricted under DOT or IATA shipping regulations

DISASSEMBLE/ ASSEMBLE K8 EMR 25, K8 EMR 39 QUARTZ GAUGES IN ORDER TO CHANGE O'RINGS UNDER ELECTRONIC HOUSING

The frequency of changing o'rings under an electronic housing should be dependent on well fluid types, temperature and gauge usage intensity. With high content H₂S we recommend changing these o'rings every 6 months or 1000 hours in well, which ever comes first.

The frequency of changing o'rings under battery housing is up to the tool operator discretion. They should be replaced at the first evidences of wear.

All Kuster electronic gauges are furnished with Parker company Viton o'rings, which cover the majority of well fluids in the field, however the last decision on which type of o'rings to use is up to the operator of the gauge.

Wrong choice could lead to tool malfunctioning and denial of warranty. Consult with the o'ring manufacturer, if you are not sure that these o'rings are suitable for your applications. It is mainly a concern for the well fluids with high content of H₂S.

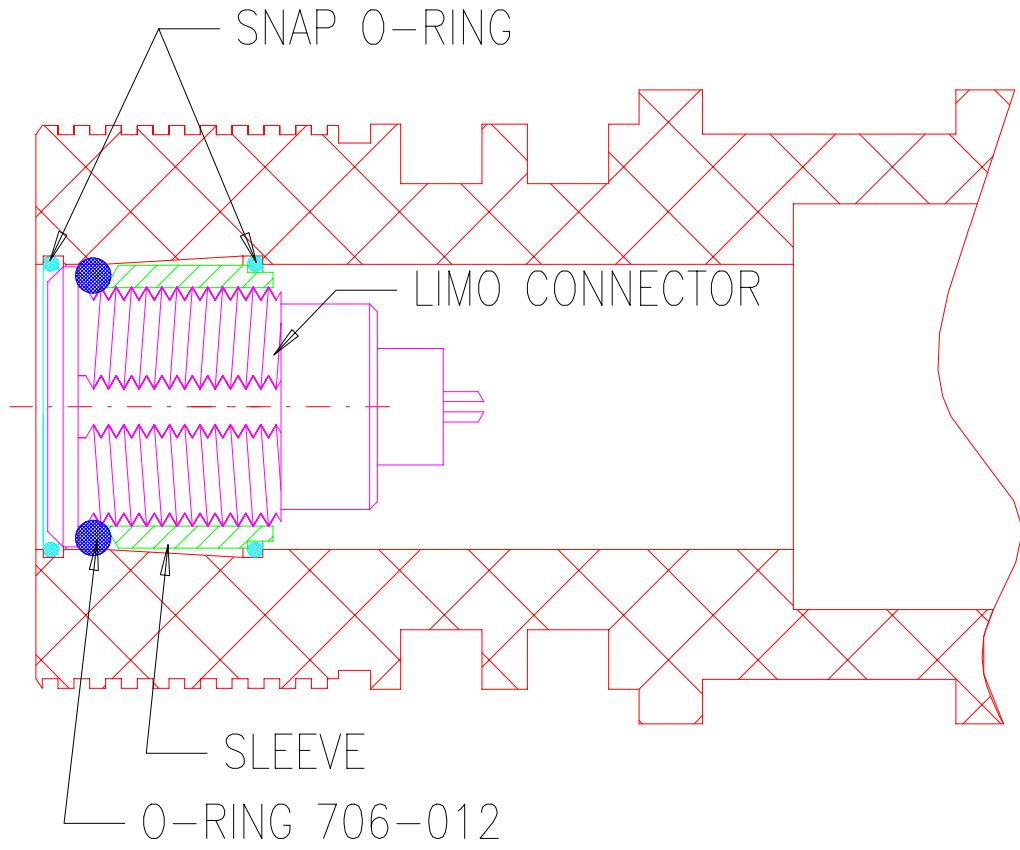
Electronic housing disassemble:

- 1). Looking at the connector that the battery pack plugs into, you should see the snap ring that holds the connector into the housing. Remove this ring. (A small jewelers screwdriver is the recommended tool to use).
- 2). Attach the removal/install tool and gently pull the connector up out of the housing. Disconnect the removal/install tool from the connector. If a removal/install tool is not available, use the comm. Box connector.
- 3). Hold the gauge with the connector hanging down. Remove the spacer from the housing.
- 4). Remove the lower snap ring. *Do not let it slip into the upper snap ring groove!*
- 5). Remove the O ring from under the connector's lip.
- 6). As you unscrew the main housing from the transducer sub feed the connector through the opening in the housing.
- 7). Remove the main housing from the electronics board-transducer sub assembly. Remove the removal/install tool from the connector.
- 8). Set the transducer sub /electronics circuit board assembly upright on a clean work bench. *(avoid touching any exposed part of the circuit board with your hand).*
- 9). Slide the new O-rings over the connector assembly and circuit board. Push them into the proper grooves in the transducer sub.

Reassembly:

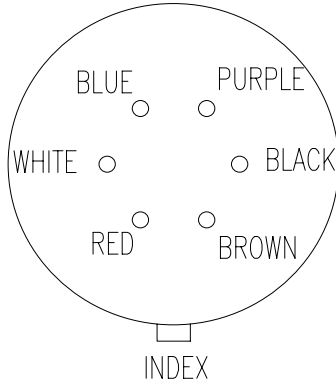
- 1). Feed the removal/install tool through the main housing from the connector opening to the transducer sub opening.
- 2). Attach the removal/install tool to the lemo connector. Push the spacer over the connector shaft and wrap some tape behind it so it can't come off of the connector when it is fed through the housing.
- 3). Feed the electronics board/connector back through main housing keeping the slack out of the connector wires. Do not pull on the connector/board assembly. Just use the install tool to guide the connector through the opening.
- 4). Once the connector/spacer is through the opening remove the install tool and the tape.
- 5). Push the lower snap ring into the connector opening and seat it on the step in the housing.
- 6). The spacer rests on top of the snap ring.
- 7). Replace the O ring under the connector lip and feed the connector and O ring through the opening. **Make sure the wires stay below the connector and spacer.** The connector can be turned to twist the wires as you feed them into the opening. This makes keeping the wires below the connector easier.

8). Press on the connector so the upper snap ring groove is visible and install the upper snap ring using a small screwdriver.



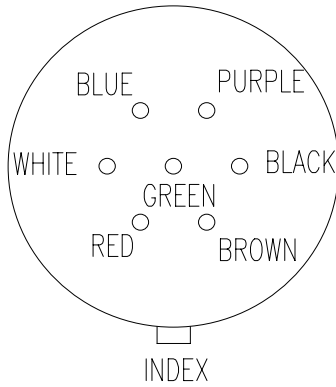
STRAIN GAUGE
ELECTRICAL CONNECTOR WIRING DIAGRAM
BOARD SIDE

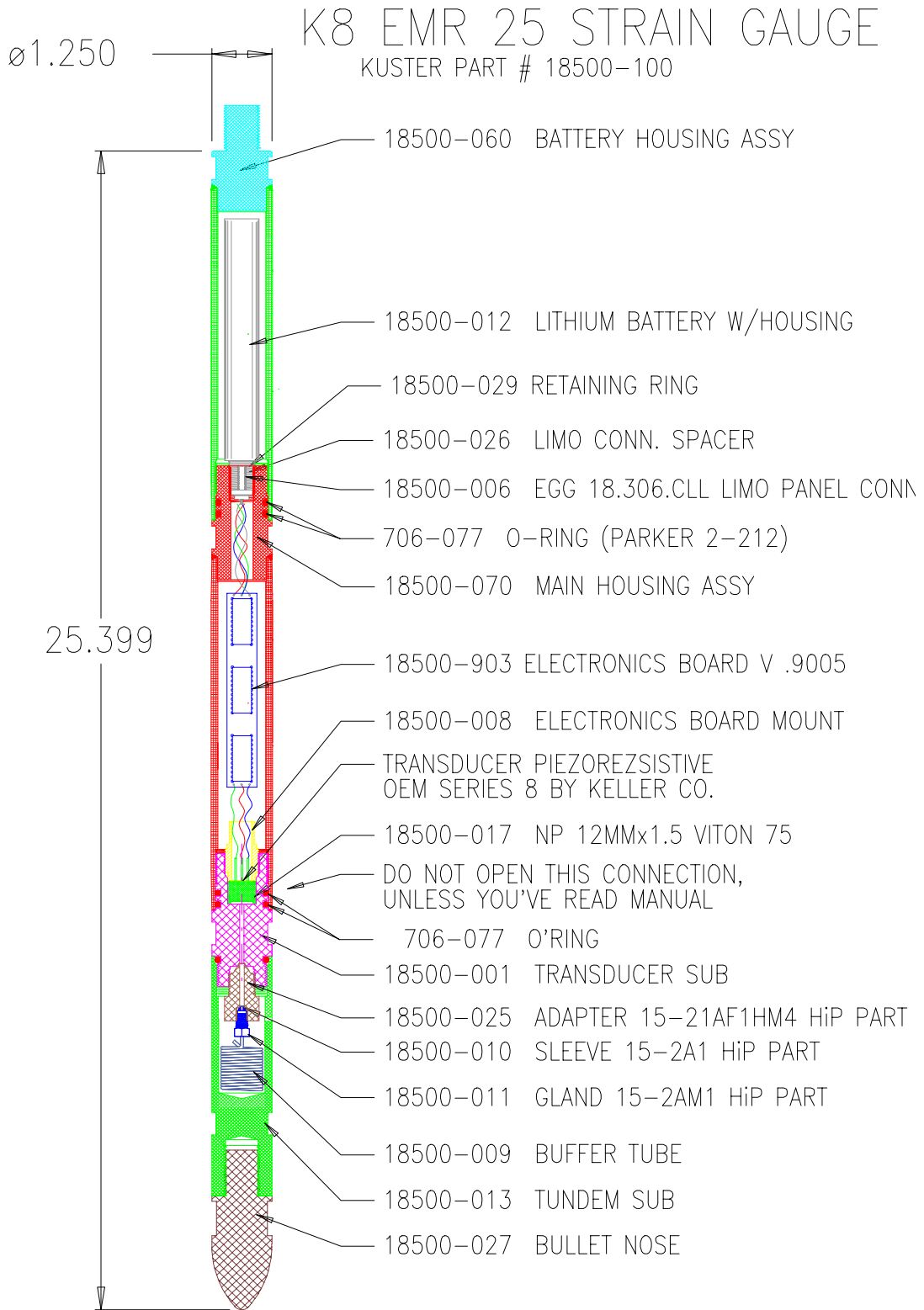
J1 - BLACK
J2 - RED
J3 - PURPLE
J4 - BLUE
J5 - WHITE
J6 - BROWN



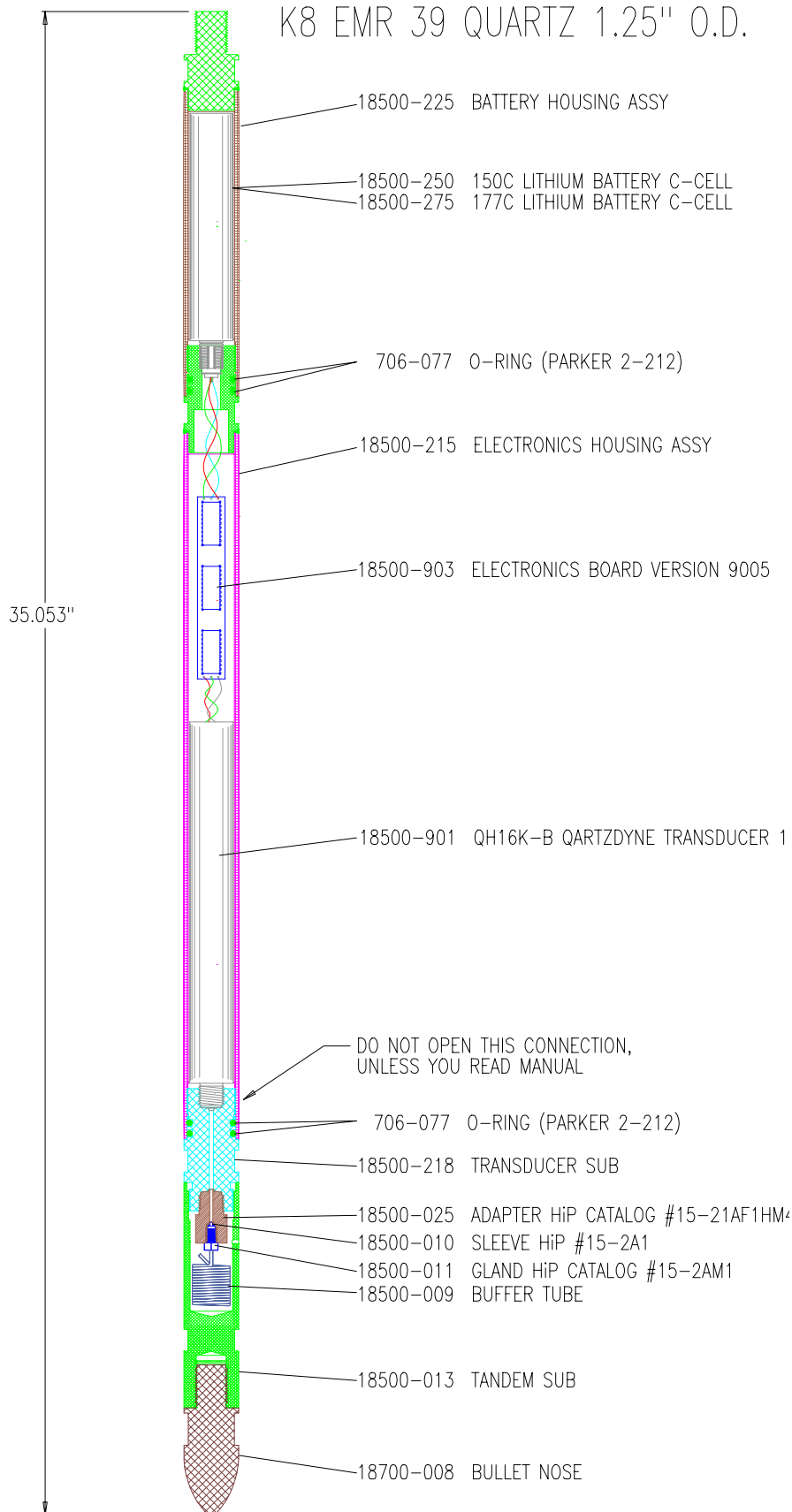
QUARTZ GAUGE
ELECTRICAL CONNECTOR WIRING DIAGRAM
BOARD SIDE

J1 - BLACK
J2 - RED
J3 - PURPLE
J4 - BLUE
J5 - WHITE
J6 - BROWN
J7 - GREEN

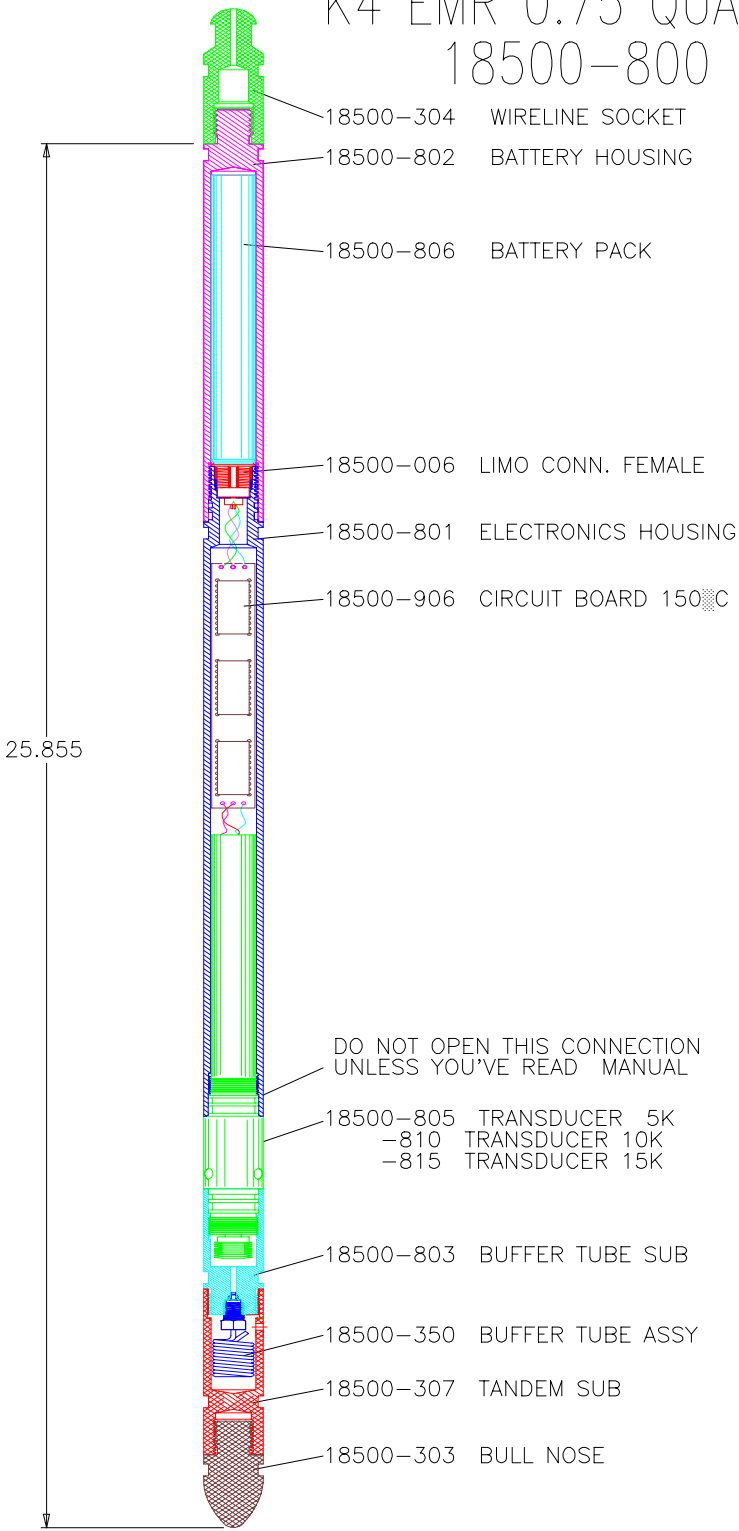




K8 EMR 39 QUARTZ 1.25" O.D.



K4 EMR 0.75 QUARTZ 18500-800



K4 EMR 3/4"
ELECTRONIC GAUGE
18500-300

